ELISYS UNO

| Recommended Field Maintenance Procedures

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1 Exercise, Lubricate and Inspect Mechanism Axis

WARNING: The probe will wash periodically or move towards the wash cup. To avoid any injuries during maintenance, disable all automatic homing by typing **IOFF** in the communication window every time before working in the path of the probe.
NOTE: Excess oil can get into the opto sensors and cause damage and/or false sensing. Use discretion when applying lubricants.

1.1 Probe X (PRX):

In the communication window, type the following commands (all commands in this text will be displayed in bold):
XREF – This command will make the probe move to its home position (the extreme left) and immediately to the reference position (the extreme right). It will then record a reference number between the two sensors. Repeat the command three or four times; the values should not vary by more than + / - 2 from each consecutive read.

XTIM – This command will initiate the Probe X mechanism to complete 20 strokes and report an elapsed time. This value will appear in the right lower window of the ELISYS UNO communication window. Repeat the command and record the times. Over time the elapsed time can increase or decrease due to wear-in or dust and grime build-up. This number will vary from one instrument to another and will determine if the drive belt of the Probe X mechanism should be tightened or loosened. Acceptable values for this test should fall between **19 and 25 seconds**.

Loosening the (yellow) drive belt will result in speeding up the mechanism. Tightening the drive belt will result in slowing down the mechanism. This can be accomplished by loosening the two screws that fasten the X idler to the right of the Probe X mechanism and adjusting the tension from there.

In addition to timing, the technician should observe the mechanism during tests for erratic movement and listen for unusual noise; both of which can lead to poor performance in the future.

1.2 Probe Z (PRZ):

Remove any racks located in the Rack 1 position. Move the probe to the left by entering the command **PRXM0300**. Send the probe down the Z axis by entering **PRZM0350**. Immediately enter the command **IOFF** to prohibit the mechanism from automatically homing during maintenance.

Clean the lead screw (drive rod) with a small stiff brush, or a toothbrush. The threads will accumulate dirt which, combined with the liquid oil will create a paste coat that increases friction on the rod, subsequently slowing it down, causing noisy operation and/or leading to a jam. Once clean, apply one to two drops of oil to the lead screw. There are two guide bearings alongside the mechanism that can be cleaned and lubricated with one drop of oil as well.

Exercise the mechanism by entering the command **ZTIM**. This will move the Probe Z mechanism up and down 20 times returning an elapsed time value. This value should be less than **14 seconds** for adequate performance.

1.3 Plate X (PLX):

Take the Plate X/Y cover off. Move the plate to the right by entering the command **PLXM0250 then IOFF**. Clean the lead screw with a stiff brush or toothbrush and add one drop of oil for lubrication. Exercise the mechanism by entering the command **PLXT**. This will move the Plate mechanism along the X axis 20 times returning an elapsed time value. This value should be between **19 and 25 seconds**.

1.4 Plate Y (PLY):

Clean the rod with a stiff brush or toothbrush. Add one to two drops of oil to the lead screw ahead of the Plate Y shuttle (attached to the lead screw and plate carrier). In addition, loosen the set screw in the front bracket, left side. Remove the guide rod slowly and clean any build-up with a rag. Replace back into the plate carrier and tighten the set screw. Add one to two drops of oil along the guide rod. Exercise the mechanism by entering the command **PLYT**. This command will move the Plate mechanism along the Y axis 20 times returning an elapsed time value. This value should be between **45 and 55 seconds**.

1.5 Wash Head Z:

Remove the wash head. Move the mechanism down by entering the command **WSHM0080** then **!OFF**. Add one drop of oil to the wash head lead screw, above the wash head arm. Exercise the mechanism by entering the command **WSHH** and then **WSHM0080**. Repeat this process several times.

1.6 Rack 1, Rack 2:

Exercise both racks by entering the commands **R1TM** and **R2TM**. This command will move both rack mechanisms along the Y axis 20 times returning an elapsed time value. This value should be less than **48 seconds**.

To clean this mechanism you must turn **OFF** the power to the instrument. Remove the two flat head screws located at the front of the rack mechanism. Only loosen the back two screws of this mechanism; there is no need to remove them completely. Slide the rack mechanism out, being observant of the length of the wires attached on the underside. Remove the three connections (power cable (yellow), control cable (grey), and ground wire (green)), taking note of their orientation for later attachment. Turn the mechanism over and clean both lead screws with a stiff brush or toothbrush. Add one to two drops of oil to each lead screw. Replace the mechanism in exactly the same manner as removal and power on the instrument. Exercise the mechanism again by entering the commands R1TM, R2TM.

2 Check Filter Voltages

Click Utilities on the menu bar, scroll down and select **Filter voltages...**. Click **Test Current Voltages**. Another option is to open the communication window and enter the command **RFVL**. All four channels (lamps) across all eight filters will report a voltage value. All values should be between **2.0 and 10.0**. If any of the values are above 10 volts, please contact the manufacturer. If lower than 2 volts, then do the following:

2.1 Clean Glasses on Channel Block:

Remove the lamp bracket. Use 70% Isopropyl alcohol on a lint free tissue and clean the four glasses on the channel block. To move the Plate X mechanism out of the way, enter the command **PLXM0200** and immediately after type **!OFF** to disable all automatic homing.

2.2 Clean Diffusers on Aperture Block:

With the lamp bracket off, remove the two screws that hold the aperture block in place. Take care not to drop the diffusers. Remove the diffusers and clean them using a lint free tissue dampened with 70% Isopropyl alcohol. Keep them clean and free of fingerprints.

2.3 Remove Dust from the Lamps:

WARNING: Do not touch the lamps with bare fingers.

Dust, the number one reason for low filter voltages, accumulates due to the constant air flow produced by the photometer fan.
Turn the lamps off by entering the command **LOFF**. Take the lamp cover off and use compressed air to blow off the dust. Hold the can in the upright position to avoid any liquids from going into the mechanism. Take care not to get moisture on any of the lamps. Note the orientation of all cables and connectors before removing any of them. Replace the lamps in their original position and test the filter voltages again. If the voltages are still lower than 2.0, check the alignment of all four lamps.

2.4 Filter Voltage Readout:

Test the voltage going to each of the lamps, make sure they are approximately 6VDC.

2.5 Lamp Alignment Check / Adjustment:

Remove the lamp bracket and place it on the side of the instrument with the lights shining on the side cover.

The brightest spot for each one of the circles should be in the center. Also, make sure that the lamps are sitting all the way down in the holder through the lamp guides. Make any adjustments as needed with the lamps OFF, use needle nose pliers to adjust and handle the lamps.

WARNING: Do not touch the lamps with bare fingers.

Remember, the lamps ca be turned off by entering the command **LOFF** and back on again by entering **LPON**. If the filter voltages are still lower than 2.0 volts, contact the manufacturer.

3 Filter Wheel Speed Check:

Enter the command **FSPD** in the communication window. This command will spin the filter wheel for one second and report an elapsed time value. This value represents how many revolutions the filter wheel completes within one second. The value should be between **.300 to .320 sec/rev.** If this number is greater or lesser than the provided specifications, then adjust the potentiometer labeled "FW Speed" on the Co-processor board. Repeat the **FSPD** command until there are three or four consecutive commands within the specified range.

4 Inspect Plate X / Y Overshoot / Undershoot:

The plate moving mechanism may excessively overshoot or undershoot over time. It overshoots if friction decreases and undershoots if friction increases. The plate moves with coordinates (through counts from the interrupter wheel) for all plate movements except reading. For reading, the instrument uses slotted flags. Plate Y is undershooting when the plate stops before getting to the programmed coordinates, or it stops immediately after seeing the flag (it usually goes just a bit past the flag, that is called "the braking distance" that it needs to come to a full stop).

4.1 How to Determine a Plate Y Undershoot / Overshoot:

Determine if the Plate Y is excessively undershooting or overshooting by entering each of the following commands respectively in the communication window:

PLTH, PLYM0750, IOFF, POSI

Record the reported value, which should not vary by more than + / - 2. Depending on the results, refer to section 4c for factors that could lead to a Plate Y undershoot, or 4d for factors leading to a Plate Y overshoot.

4.2 How to Determine a Plate X Undershoot / Overshoot:

Determine if the Plate X is excessively undershooting or overshooting by entering the following commands respectively in the communication window:

PLTH, PLXM0270, IOFF, POSI

Record the reported value, which should not vary by more than + / - 2. If the mechanism is reporting an undershoot, please refer to section 1c for instructions on how to lubricate the mechanism. Plate X overshoots are rarely a problem experienced; therefore, if you are experiencing a Plate X overshoot please contact the manufacturer.

4.3 Factors that Could Create a Plate Y Undershoot:

Obstructions or debris between the plate carrier and the plate carrier platform (ie. Dry buildup of a chemical spill) could lead to a Plate Y undershoot. Visually check for any obstructions such as loose parts or unseated micro wells rubbing against the cover. Remove the plate carrier by remove the guide rod on the left. This can he accomplished by loosening the set screw on the left side of the front bracket of the plate moving mechanism. Clean the plate carrier bed and the plate carrier itself. Inspect for any bumps on the plate carrier tape and surface.

A dry guide rod can lead to the inability to read the 11th and 12th rows of the plate; ensure that the guide rod is not dry. If so, apply one to two drops of oil to the guide rod and exercise the mechanism. Refer to section 1d for pro

per lubrication of the plate Y drive rod.

Inspect the wave washer to ensure that it is not overly compressed. This can happen if the wave washer was incorrectly adjusted, or if the plate mechanism was taken apart and incorrectly put back together. See section 4e for waver washer adjustment.

4.4 Factors that Could Create a Plate Y Overshoot:

An excessive amount of oil on the Plate Y lead screw can cause a bit of overshoot. Clean the rod with a lint free paper tissue (if available). Exercise the plate by entering the following commands respectively:

PLYM0750, PLTH

The first command will move the plate towards the back of the instrument, while the second will bring the plate home. Repeat this command several times to ensure that the mechanism is not too dry and binding up. If so, apply one drop of oil to the lead screw. Test for overshoot again.

4.5 Wave Washer Adjustment:

Do this by loosening the set screw and compressing (more friction) or expanding (less friction) the wave washer slightly. If the plate movement appears labored, the wave washer is too tight (compressed). Test the mechanism for an overshoot / undershoot every time an adjustment is made to the wave washer. In addition, check to ensure that the Plate Y times are still within specification. Refer to section 1d for the proper specifications on time.

5 Check Photometer Alignment

NOTE: This step may be easiest with the right panel (bottle enclosure) of the instrument removed.

The photometer channel block, which contains the lenses, is what is aligned to the plate. Place an empty plate into the plate carrier. Open the communication window and enter the following commands in respective order.

PLTH, RWELA01721, IOFF

This command will home the plate, move to read well A01 and stop. This will align positions A01, A04, D01 and D04 to the channel block of the photometer base. Remove the lamp bracket by unscrewing the one screw that holds the top of the photometer to the base. Stand directly over the plate and look at positions A04 and D04, ensuring that your vision path is directly perpendicular to the channel block lenses.

The channel block lenses should be visible through the holes of the plate carrier and centered. If the channel block is not close to being centered, loosen the two screws that hold the photometer base to the floor of the Plate X/Y moving mechanism.

Move the photometer until the channel block holes are centered to the plate holes in positions A04 and D04.

Once aligned, tighten the screws and repeat the following commands to confirm a good alignment:

PLTH, RWELA01721, IOFF

If alignment appears good then type the following commands to check alignment from a different perspective:

PLTH, RWELH12721, IOFF

These commands will do the same as the previous, only aligned to the H row of the plate. That shows to the technician that the photometer is aligned to the top right and bottom left points of the plate.

If alignment appears good at one point of the plate, but not the other, there is a possibility of undershooting or overshooting. Refer to section 4 for instructions on this area.

After aligning the photometer, parameter verification must be carried out. Enter the following commands in the communication window:

RWELA01721, IOFF, POSI

Visually confirm that the alignment is ok, and record the positioning values (obtained from the POSI command) for the Plate X and Y coordinates located in the communication window. The Y coordinate will be preceded by a 'dash', followed by the X coordinate. Record these parameters.

Enter these coordinates into the parameter list by entering the following commands:

PARM4Xxxxx, PARM4Yyyyy (Where xxxx and yyyy are the numbers recorded from the POSI command. There must be four digits entered; therefore, place a zero at the front of the number. For example, if POSI returned a -470 for the Y value, you will enter PARM4Y0470. Once complete enter the command **PARM** in the communication window and a list of the instrument's parameters will appear. Review the
" -4 Read Y=0465, X=0160 " line of the parameters to ensure that they match the coordinates you just entered.

6 Inspect the Fluid Handling System for Leaks

Check o-rings and connections for tightness.

Check tightness on the Teflon seals (plungers) for both syringes; there should be even movement throughout each syringe stroke and no signs of leakage.

Clean the probe tip and wash head with the cleaning wires provided in the spare parts kit shipped with each instrument; remove parts for easier access. After cleaning, rinse the wash head with Deionized water. Check the prime bottle for debris or discoloration and wash to eliminate any residue buildup (usually found at the bottom).

7 Cleaning

7.1 Bleach Cleaning of Syringes (Monthly):

Replace the prime bottle with a bottle containing 10% Sodium hypochlorite solution (beach). Then select **Routines** on the menu and scroll down to **Prime Syringes**. Repeat the prime five times to ensure a thorough rinsing of the syringes. When finished, replace the prime bottle with one containing only deionized water and repeat the prime syringes step ten times to ensure that all bleach is out of the fluid handling system.

7.2 Bleach Cleaning of Wash Head Tubing:

WARNING: When opening wash, rinse or waste bottles, put the system on standby. Enter the command **STBY** in the communication window to ensure that the system is on standby.

To eliminate residue build-up on the walls of the tubing, replace the rinse and wash bottles with 30% sodium hypochlorite (bleach) solution. Then select **Routines** on the menus and scroll down to **Prime Rinse** and **Prime Washer**. Perform each step five times to ensure a thorough washing of the system. When complete, wash out or replace the rinse and wash bottles with pure deionized water and repeat the priming steps above ten times. Remove the wash head and manually rinse with deionized water to ensure there is no bleach remaining in the system.

This procedure, if followed periodically, will ensure longevity of the fluid handling system's tubing.

7.3 Alcohol Cleaning of Syringes:

Replace the prime bottle with a bottle containing 70% Isopropyl alcohol. Then select **Routines** on the menu and scroll down to **Prime Syringes**. Repeat the process three times. When complete, replace the alcohol with the prime bottle filled with deionized water and repeat the priming steps above four times. This procedure will prime the tubing and syringes of any air bubbles trapped in the system.

8 Performance Verification

8.1 Verification of setup parameters:

To confirm that the instrument t is properly positioning the probe, racks, plate and wash head, select **Utilities** on the menu bar, scroll down to **Alignment** and select each mechanism in order. Follow the prompts and verify or adjust positioning of parameters if necessary.

8.2 Channel blanks:

Select **Utilities** on the menu bar and scroll down to **Channel Blank**.... Follow the instructions provided by the software. See the ELISYS UNOuser manual for more details on channel blanks. Always utilize new micro wells and only use the provided blanking solution (0.5 NaOH with 0.01% Triton x-100), never use plain water because it does not have a uniform meniscus and will results in incorrect readings. The utility will inform you of the results.
Once complete, open the communication window and enter the command **SBLK**. This command will bring up the instrument's stored channel blanks. All results should be between **.240** and **.400**. If not, replace the wells and perform the test again.

8.3 Self Test:

The Self Test utility provided in the ELISYS UNO software, will check the performance of the instrument. Place a plate with new micro wells into the plate carrier and only utilize the provided performance check materials provided with the instrument. Click on **Utilities** on the menu bar and scroll down to **Self Test...** and follow the instructions provided by the software. This test will pipette and read repeats of three volume levels of a dye to span the linear range of the photometer. The results (%CV) will be displayed in a report on screen, which can then be printed for record keeping. All results should be less than 2%CV, with the exception of the small sample (2ul), which should be less than 3%CV.

A Self Test will test the instrument's performance without any other factors involved. Bad reproducibility or poor performance could be caused by a problem in one of the following three factors: the instrument, the reagent or the programming. Good results in a Self Test will eliminate hardware problems as a probable cause. Refer to the owner's manual for assay programming. Check the expiration dates on the reagents; if necessary, run the same reagents manually to verify their quality.